CLAIMS

1. A method of combining first and second attribute sets each comprising at least one attribute/value pair by which a named attribute is assigned a value that comprises one of a end value and a further attribute set; the method comprising carrying out a merge operation by applying to the first and second attribute sets, as items-to-be-merged, a merge operator by which:

- where at least one of the items-to-be-merged is a said end value, the value of the merged items is the value of a predetermined one of the items-to-be-merged; and

- where both items-to-be-merged are attribute sets, the value of the merged items comprises:

    - the attribute/value pairs, if any, of attributes that occur in only one of the items-to-be-merged, and

    - attribute/value pairs for attributes, if any, occurring in both items-to-be-merged with the value of each such pair being the value resulting from the application of the merge operator to the values of the attribute appearing in each item-to-be-merged, the merge operator being recursively applied as required to merge the attribute values.

2. A method according to claim 1, wherein at least one said attribute is assigned a value that is a reference to a said named attribute, the merge operation being effected by repeatedly carrying out the following steps (a) and (b) in succession:

(a) recursively applying the merge operator until a reference is encountered as a said item-to-be-merged;

(b) de-referencing, so far as possible, an encountered reference without use of items yet to be merged.

3. A method according to claim 2, wherein this de-referencing of a reference involves:

- where the reference is to a named attribute to which an end value or attribute set is assigned: copying that value or set;

- where the reference is to the start of a chain of two or more references each pointing to a respective named attribute the value of which is the next reference in the chain with the chain ending when a reference in the chain points to a named attribute to which an end value or attribute set is assigned: following the chain of references and

5 copying the end value or set at the end of the chain.

4. A method according to claim 1, wherein at least one conformance predicate is associated with at least one of said first and second attribute sets, the merge operation carrying across to the resulting set all the conformance predicates associated with the first

10 and second sets.

5. A method according to claim 4, wherein following the merge operation, the or each conformance predicate associated with the resultant set is evaluated.

15 6. A method according to claim 1, wherein a group of one or more identifiers is associated with each of the first and second sets, this group of identifiers comprising a unique identifier for the subject set and the unique identifiers of any other sets that have been merged at any stage in the creation of the subject set, the said merge operation that is effected on the first and second sets involving creating a group of identifiers for the set

20 produced by the merge operation, this group comprising a unique identifier for the set and the identifiers contained in the group of identifiers of the first and second sets.

7. A method according to claim 6, wherein the provenance of one set is tested by comparing its associated group of identifiers with the group of identifiers of another set,

25 said one set being determined as being derived from said other set if all the identifiers of the group of identifiers associated with said other set are contained in the group of identifiers associated with said one set.

8. A method according to claim 1, wherein at least one said attribute is assigned a value

30 that is a reference to a said named attribute and wherein a group of one or more identifiers is associated with each set, this group of identifiers comprising a unique identifier for the subject set and the unique identifiers of any other sets that have been merged at any stage

in the creation of the subject set, the said merge operation that is effected on the first and second sets involving:

- whenever a reference is resolved by copying a set, a group of identifiers is associated with the copy, this group comprising a new unique identifier for the copy and the identifiers of the group of identifiers of the set that has been copied; and

- creating a group of identifiers for the set produced by the merge operation, this group comprising a said unique identifier for the set and the identifiers contained in the group of identifiers of the first and second sets.

9. A method according to claim 8, wherein the provenance of one set is tested by comparing its associated group of identifiers with the group of identifiers of another set, said one set being determined as being derived from said other set if all the identifiers of the group of identifiers associated with said other set are contained in the group of identifiers associated with said one set.

10. A method according to claim 1, wherein the merge operation is effected in respect of at least one further set in addition to the first and second sets, the merge operation being effected first on said first and second sets and then the resultant set being merged with a first of the further sets, and the set so produced being merged with any remaining further set in a recursive manner.

11. A method according to claim 1, wherein the first attribute set is a resource description, the second attribute set being combined with the resource description by the merge operator to set specific end values for at least one of the attributes of the resource description.

12. A method according to claim 1, wherein both the first and second attribute sets are resource descriptions, these descriptions being combined by the merge operator to form a resource description for a new resource that includes the attributes of both the first and second resource descriptions.

13. A method of configuring a resource described by a resource description in which first and second sets of attributes are designated to be combined together by a merge operator, the method comprising the steps of:

(a) merging the first and second attribute sets by the method of claim 1, and

5 (b) configuring the resource in accordance with the attribute values of the merged set.

14. A method of combining first and second attribute sets each comprising at least one attribute/value pair by which a named attribute is assigned a value that comprises one of a end value and a further attribute set; the method involving carrying out a merge operation

10 that combines the attribute/value pairs of the first and second attribute sets according to their levels in their respective attribute trees with conflicts arising between attributes having the same path in each tree being resolved, on a top-down basis, according to predetermined rules.

15 **15.** A computer program product for use in combining first and second attribute sets each comprising at least one attribute/value pair by which a named attribute is assigned a value that comprises one of a end value and a further attribute set; the computer program product being arranged to control the operation of a computing apparatus running the program product to cause the apparatus to carry out a merge operation by applying to the first and

20 second attribute sets, as items-to-be-merged supplied as data to the apparatus, a merge operator by which:

- where at least one of the items-to-be-merged is a said end value, the value of the merged items is the value of a predetermined one of the items-to-be-merged; and

- where both items-to-be-merged are attribute sets, the value of the merged items

25 comprises:

- the attribute/value pairs, if any, of attributes that occur in only one of the items-to-be-merged, and

- attribute/value pairs for attributes, if any, occurring in both items-to-be-merged with the value of each such pair being the value resulting from the application

30 of the merge operator to the values of the attribute appearing in each item-to-be-merged, the merge operator being recursively applied as required to merge the attribute values.

16. A computer program product according to claim 15, wherein where at least one said attribute is assigned a value that is a reference to a said named attribute, the program product is arranged to cause the computing apparatus to carry out the merge operation by 5 repeatedly carrying out the following steps (a) and (b) in succession:

(a) recursively applying the merge operator until a reference is encountered as a said item-to-be-merged;

(b) de-referencing, so far as possible, an encountered reference without use of items yet to be merged.

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17. A computer program product according to claim 16, wherein the program product is arranged to cause the computing apparatus to carry out the de-referencing of a reference by:

- where the reference is to a named attribute to which an end value or attribute set is assigned: copying that value or set;

15   - where the reference is to the start of a chain of two or more references each pointing to a respective named attribute the value of which is the next reference in the chain with the chain ending when a reference in the chain points to a named attribute to which an end value or attribute set is assigned: following the chain of references and copying the end value or set at the end of the chain.

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18. A computer program product according to claim 15, wherein where at least one conformance predicate is associated with at least one of said first and second attribute sets, the program product is arranged to cause the computing apparatus, in carrying out the merge operation, to carry across to the resulting set all the conformance predicates 25 associated with the first and second sets.

19. A computer program product according to claim 18, wherein the program product is arranged to cause the computing apparatus to evaluate, following the merge operation, the or each conformance predicate associated with the resultant set.

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20. A computer program product according to claim 15, wherein where a group of one or more identifiers is associated with each of the first and second sets, the program product is

arranged to cause the computing apparatus, in carrying out the said merge operation on the first and second sets, to create a group of identifiers for the set produced by the merge operation, this group comprising a unique identifier for the set and the identifiers contained in the group of identifiers of the first and second sets.

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21. A computer program product according to claim 20, wherein the program product is arranged to cause the computing apparatus to test the provenance of one said set by comparing its associated group of identifiers with the group of identifiers of another said set, said one set being determined as being derived from said other set if all the identifiers

10   of the group of identifiers associated with said other set are contained in the group of identifiers associated with said one set.

22. A computer program product according to claim 15, wherein where at least one said attribute is assigned a value that is a reference to a said named attribute and a group of one

15   or more identifiers is associated with each set, the program product is arranged to cause the computing apparatus, in carrying out the said merge operation on the first and second sets :
-    whenever a reference is resolved by copying a set, to associate a group of identifiers with the copy, this group comprising a new unique identifier for the copy and the identifiers of the group of identifiers of the set that has been copied; and

20   - to create a group of identifiers for the set produced by the merge operation, this group comprising a said unique identifier for the set and the identifiers contained in the group of identifiers of the first and second sets.

23. A computer program product according to claim 22, wherein the program product is

25   arranged to cause the computing apparatus to test the provenance of one said set by comparing its associated group of identifiers with the group of identifiers of another set, said one set being determined as being derived from said other set if all the identifiers of the group of identifiers associated with said other set are contained in the group of identifiers associated with said one set.

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24. A computer program product according to claim 15, wherein the program product is arranged to cause the computing apparatus to carry out the merge operation in respect of at

least one further set in addition to the first and second sets, the merge operation being effected first on said first and second sets and then the resultant set being merged with a first of the further sets, and the set so produced being merged with any remaining further set in a recursive manner.

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25. A computer program product according to claim 15, wherein the first attribute set is a resource description, the second attribute set being combined with the resource description by the merge operator to set specific end values for at least one of the attributes of the resource description.

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26. A computer program product according to claim 15, wherein both the first and second attribute sets are resource descriptions, these descriptions being combined by the merge operator to form a resource description for a new resource that includes the attributes of both the first and second resource descriptions.

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27. Computer apparatus for combining first and second attribute sets each comprising at least one attribute/value pair by which a named attribute is assigned a value that comprises one of a end value and a further attribute set; the apparatus comprising a set merging arrangement for carrying out a merge operation, the set merging arrangement comprising:

20   - merge operator means for applying a merge operator to items to be merged, and

        - control means for controlling the carrying out of said merge operation, the control means being arranged to apply said first and second attribute sets, as items to be merged, to the merge operator means;

the merge operator means comprising:

25   - first means operative, where at least one of the items to be merged is a said end value, to cause the value of the merged items to be the value of a predetermined one of the said items to be merged; and

        - second means, operative where both items to be merged are attribute sets, to cause the value of the merged items to comprise:

30   - the attribute/value pairs, if any, of attributes that occur in only one of the items-to-be-merged, and

-    attribute/value pairs for attributes, if any, occurring in both items to be merged
     with the value of each such pair being the value resulting from the application
     of the merge operator to the values of the attribute appearing in each item to be
     merged, the control means causing the merge operator to be recursively applied
5   by merge operator means as required to merge the attribute values.

28. Apparatus according to claim 27, wherein at least one said attribute has a value that is
a reference to a said named attribute, the set merging arrangement further comprising de-
referencing means for de-referencing, so far as possible, an encountered reference without
10 use of items yet to be merged, and the control means being arranged to cause said merge
operation to be effected by repeatedly:

- causing the merge operator means to recursively apply the merge operator until a
  reference is encountered as a said item to be merged;

- causing the de-referencing means to de-reference, so far as possible, an encountered
15   reference without use of items yet to be merged.